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PRINCIPAL INVESTIGATOR: Marianne Ulcickas Yood, DSC MPH  
Kenneth Rothman, Ph.D.

CONTRACTING ORGANIZATION: Henry Ford Health System  
Detroit, Michigan 48202

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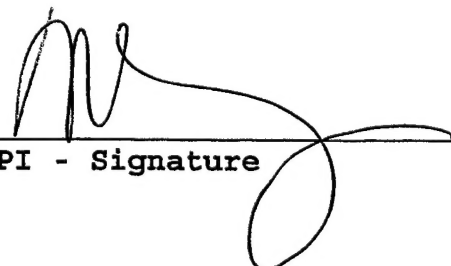
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**A Comparison of Breast Cancer Treatment Regimens by Demographic  
Characteristics (DAMD17-97-1-7302), 1999 Report**

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## INTRODUCTION

In the United States, survival for African American women with breast cancer is inferior to that for European American women. The 1970s and 1980s marked a time of relatively stable rates of mortality among European American women with breast cancer, but increasing rates for African Americans<sup>1</sup>. However, the decline in mortality observed in the early 1990s for European American with breast cancer was not observed in African Americans<sup>1,2</sup>. Poorer survival among African Americans has been attributed to biological characteristics of the tumor, advanced stage at diagnosis, lower socioeconomic status (SES), barriers to health care, diagnostic and treatment delays<sup>3,4</sup> and a higher prevalence of comorbid conditions<sup>5,6</sup>. Although use of mammography by African American women has been reported to lag behind Caucasian women<sup>7</sup>, recent research indicates that the racial discrepancy is narrowing<sup>8</sup>. However, it is too soon to see how increased use of mammography among African Americans will affect survival. The purpose of this study was to examine racial differences in breast cancer treatment and survival.

## BODY

The results of our study comparing survival for African American and European American women with breast cancer were reported in detail in our annual report dated October, 1998. Since our last report, these results have been published in the *Journal of the National Cancer Institute*<sup>9</sup>. A reprint of this manuscript is include in the Appendix. We have also completed a comparison of surgical treatment for breast cancer by race. These results were published in *Surgery*<sup>10</sup>, and a reprint is included in the appendix.

## KEY RESEARCH ACCOMPLISHMENTS

- Found that the 5-year survival for African American women was 77%, compared to 84% for European American women.
- Demonstrated that the effect of race on survival from breast cancer was eliminated after adjusting for sociodemographic characteristics and stage of disease at diagnosis.
- Observed similar patterns of surgical management of breast cancer for African American and European American women, adjusting for stage and sociodemographic characteristics.

## REPORTABLE OUTCOMES

- Two manuscripts published (see appendix):

Ulcickas Yood M, Johnson CC, Blount A, Abrams J, Wolman E, McCarthy BD, Raju U, Nathanson DS, Worsham M, Wolman SR. Lack of racial differences in breast cancer survival in a managed care population. *Journal of the National Cancer Institute* 1999;1487-1491.

Velanovich V, Ulcickas Yood M, Bawle U, Nathanson SD, Strand VF, Talpos GB, Szymanski W, Lewis FR. Racial differences in the presentation and surgical management of breast cancer. *Surgery* 1999;125:375-379.

## CONCLUSIONS

The results of this study quantify and compare the survival of African American and European American women with breast cancer. These results indicate that in a managed care population, where access to care is equivalent, racial differences in survival are negligible after adjustment for stage, income, age and marital status. These results lend support to the view that the effect of an intrinsic difference in tumor biology (if any) must be small and exercised mainly through its influence on stage at diagnosis.

We also studied a subset of women with breast cancer covered by HMO as well as other forms of insurance. In this population, we found no material difference in the surgical management of breast cancer after adjusting for sociodemographics and stage.

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## APPENDICES

- Two manuscripts published:

Ulcickas Yood M, Johnson CC, Blount A, Abrams J, Wolman E, McCarthy BD, Raju U, Nathanson DS, Worsham M, Wolman SR. Lack of racial differences in breast cancer survival in a managed care population. *Journal of the National Cancer Institute* 1999;1487-1491.

Velanovich V, Ulcickas Yood M, Bawle U, Nathanson SD, Strand VF, Talpos GB, Szymanski W, Lewis FR. Racial differences in the presentation and surgical management of breast cancer. *Surgery* 1999;125:375-379.



# Race and Differences in Breast Cancer Survival in a Managed Care Population

Marianne Ulcickas Yood, Christine Cole Johnson, Angela Blount, Judith Abrams, Eric Wolman, Bruce D. McCarthy, Usha Raju, David S. Nathanson, Maria Worsham, Sandra R. Wolman

**Background:** African-American women with breast cancer have poorer survival than European-American women. After adjustment for socioeconomic variables, survival differences diminish but do not disappear, possibly because of residual differences in health care access, biology, or behavior. This study compared breast cancer survival in African-American and European-American women with similar health care access. **Methods:** We measured survival in women with breast cancer who are served by a large medical group and a metropolitan Detroit health maintenance organization where screening, diagnosis, treatment, and follow-up are based on standard practices and mammography is a covered benefit. We abstracted data on African-American and European-American women who had been diagnosed with breast cancer from January 1986 through April 1996 ( $n = 886$ ) and followed these women for survival through April 1997 (137 deaths). **Results:** African-American women were diagnosed at a later stage than were European-American women. Median follow-up was 50 months. Five-year survival was 77% for African-American and 84% for European-American women. The crude hazard ratio for African-American women relative to European-American women was 1.6 (95% confidence interval [CI] = 1.1–2.2). Adjusting only for stage, the hazard ratio was 1.3 (95% CI = 0.9–1.9). Adjusting only for sociodemographic factors (age, marital status, and income), the hazard ratio was 1.2 (95% CI = 0.8–1.9). After adjusting for age, marital status, income, and stage, the hazard ratio was 1.0 (95% CI = 0.7–1.5). **Conclusion:** Among women with similar medical care access since before their diagnoses, we found ethnic differ-

ences in stage of breast cancer at diagnosis. Adjustment for this difference and for income, age, and marital status resulted in a negligible effect of race on survival. [J Natl Cancer Inst 1999;91:1487–91]

In the United States, survival for African-American women with breast cancer is inferior to that for European-American women (1). The 1970s and 1980s marked a time of relatively stable rates of mortality among European-American women with breast cancer but of increasing rates for African-American women (1). The decline in mortality observed in the early 1990s for European-American women with breast cancer was not observed in African-American women (1,2). Poorer survival among African-Americans has been attributed to biologic characteristics of the tumor, advanced stage at diagnosis, lower socioeconomic status (SES), barriers to health care, diagnostic and treatment delays (3,4), and a higher prevalence of comorbid conditions (5,6). Although use of mammography by African-American women has been reported to lag behind use by Caucasian women (7), research (8) indicates that this racial discrepancy is narrowing. However, it is too soon to see how increased use of mammography among African-American women will affect survival.

Most investigations (9–11) have found differences in tumor stage at disease presentation across ethnic groups. Use of multivariate models to control for biologic differences and sociodemographic characteristics has usually reduced but not eliminated the racial differential in survival (6,12–15). Many investigators (16–19) have attributed the mortality differences primarily to racial disparity in SES, by way of its influence on diagnostic delays or even a lag in benefiting from medical advances (20). Others (6,9,10) have perceived an important role for intrinsic differences in tumor aggressiveness.

We present analyses of breast cancer survival in a population of health maintenance organization (HMO) members where screening, diagnosis, treatment, and follow-up patterns are based on practice standards and are similar for all members of the population served within a large, multidisciplinary group practice. We selected this population to minimize heterogeneity in care delivery and to minimize financial barriers to health care.

## METHODS

### Setting

The setting for this study was the Health Alliance Plan (HAP) HMO. HAP is located in southeastern Michigan and is the largest HMO in Michigan, with more than 450 000 members. Approximately 20% of these members are African-American, 53% are female, and 57% are cared for by physicians in the Henry Ford Medical Group (HFMG). Our study population was drawn from HAP members served by the HFMG. The HFMG is a large group practice that includes an urban medical center in Detroit with primary and specialty care clinics and 26 smaller clinics throughout urban and suburban southeastern Michigan.

The HFMG maintains a computerized tumor registry database accredited by the American College of Surgeons. Registry staff use a thorough case-finding system, including review of all pathology and cytology reports, as well as radiation and oncology consultations. The American Joint Commission on Cancer staging system (21)—called “TNM staging”—is used to determine the stage of disease by evaluating tumor size, extent of invasion, microscopic involvement of lymph nodes, and presence of metastases. HFMG registry staff link these data with Detroit area Surveillance, Epidemiology, and End Results (SEER)<sup>1</sup> Program records and conduct annual follow-up for vital status and recurrence. Follow-up information is complete for 94% of the women in the tumor registry.

### Ascertainment of Case Patients

By use of the HFMG cancer registry, we identified all African-American and European-American women with incident breast cancer first diagnosed from January 1986 through April 1996. To minimize heterogeneity in clinical practice and access to care just before diagnosis, we limited the study population to women continuously enrolled in HAP for at least 1 year before diagnosis and assigned to a primary care physician within the HFMG at the time of diagnosis. We defined continuous enrollment as no

*Affiliations of authors:* M. Ulcickas Yood, Josephine Ford Cancer Center and Center for Clinical Effectiveness, Henry Ford Health Sciences Center, Detroit, MI, and Bristol-Myers Squibb, Wallingford, CT; C. C. Johnson, J. Abrams (Josephine Ford Cancer Center and Department of Biostatistics and Research Epidemiology), A. Blount (Josephine Ford Cancer Center), B. D. McCarthy (Center for Clinical Effectiveness), U. Raju, M. Worsham, (Josephine Ford Cancer Center and Department of Pathology), D. S. Nathanson (Josephine Ford Cancer Center, and Department of Surgery), Henry Ford Health Sciences Center; E. Wolman, Department of Systems Engineering and Operations Research, George Mason University, Fairfax, VA; S. R. Wolman, Department of Pathology, Uniformed Services University of the Health Sciences, Bethesda, MD.

*Correspondence to:* Marianne Ulcickas Yood, D.Sc., M.P.H., Josephine Ford Cancer Center, 1 Ford Place, 5C, Detroit, MI 48202 (e-mail: ulcickam@bms.com).

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more than a 60-day gap in coverage according to membership files.

## Outcome Data

We used several sources to identify follow-up data. First, we obtained vital status, date of death (if applicable), and date last known alive from the HFMD tumor registry. Next, for those women thought to be alive, we used HFMD administrative billing data to obtain information about hospitalizations and outpatient visits from January 1986 through April 1997. We used the billing data to update the tumor registry date where appropriate.

## Identification of Related Variables

By use of the tumor registry, we obtained information on tumor characteristics, date of diagnosis, pathologic stage at diagnosis (including tumor size), and demographic factors (race, date of birth, and marital status). The demographic variables were primarily obtained from a self-administered questionnaire completed by new patients. We geocoded addresses from billing files into census block groups. We estimated household income for each woman by use of block group level median household income from the 1990 census data. Information about duration of HAP membership and mammography benefits was downloaded from the HMO membership files.

## Statistical Methods

To evaluate the association between stage and race, we fit a multinomial logistic model in which we included pathologic stage (0, I, II, III, or IV) as the dependent variable and race (European-American or African-American) as the independent variable. We compared survival between African-American and European-American women by use of the hazard ratio and 95% confidence interval (CI) calculated from Cox proportional hazards models. In the model, we included marital status (unmarried or married), age at diagnosis (<55 years or ≥55 years [corresponding to the mean of this dataset]), estimated household income (<\$35 000 or ≥\$35 000 [likewise, the mean]), and pathologic stage (0, I, II, III, or IV) as indicator terms. Age of less than 55 years, married, income below \$35 000, and stage II disease were the reference categories used in the adjusted model (because they included the largest number of women). All variables included in the model were chosen on the basis of known relationships with both breast cancer survival and race (i.e., as potential confounders). The assumption of proportional hazards was assessed graphically and by use of Schoenfeld's  $\chi^2$  goodness-of-fit procedures (22).

We considered the possibility that our method of updating the tumor registry's "date last known alive" with visit data would bias our estimates of survival if one ethnic group were more likely to have contact with the HFMD following diagnosis. Therefore, we conducted the analysis twice: First, we included only tumor registry follow-up dates; second, we used the billing data in addition. Differences between the two approaches were found to be negligible; therefore, analyses including the updated data are used in this report.

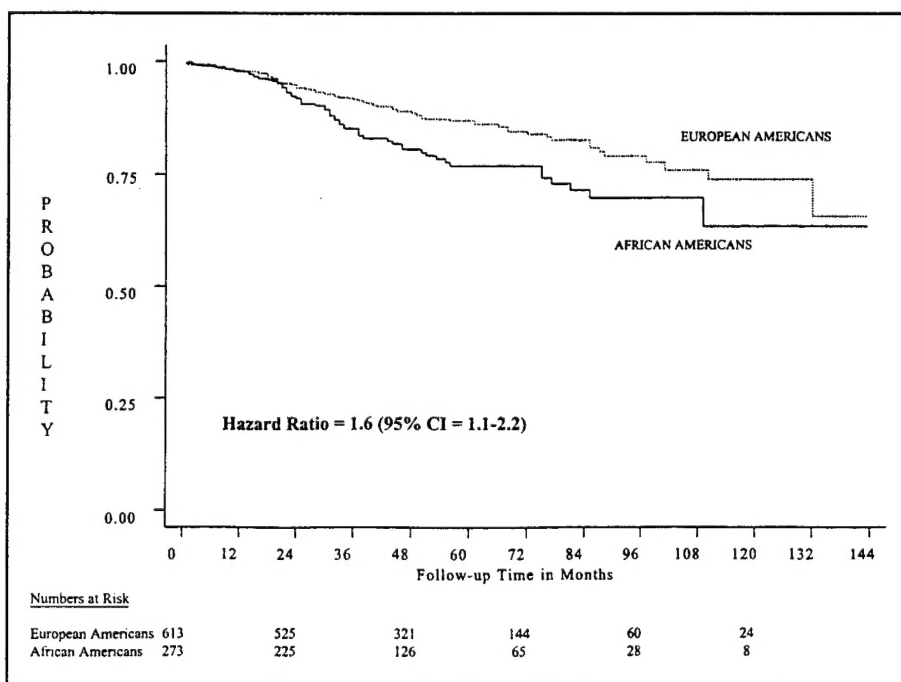
## RESULTS

We identified 1321 African-American and European-American women members of HAP who were diagnosed with breast cancer from January 1986 through April 1996 and for whom mammography was a fully covered benefit. From this group, we excluded 161 women because they were not assigned to HFMD physicians at the time of diagnosis and an additional 274 women because they were not continuously enrolled in HAP for 1 year before diagnosis, for a final sample of 886 women. The proportion of African-Americans (30%) was the same among the women excluded and the study group.

The median follow-up time was 50 months overall and was similar for African-American (49 months) and European-American (50 months) women who were alive at the end of follow-up. A total of 137 deaths occurred during the study period. Table 1 shows the baseline demographic and tumor-specific characteristics of the study population. The multinomial logistic model indicated that European-American women were more likely to

have earlier stage disease at diagnosis than were African-American women. When we examined this issue more closely, European-Americans were more likely than African-Americans to have disease of an earlier stage (0 or I), with an absolute difference of 11% (95% CI = 3%–18%). Among women diagnosed with stage II disease (which includes cancers with and without lymph node involvement), we found no material difference between African-American and European-American women in the proportions with positive lymph nodes (difference = 5%; 95% CI = –6% to 17%).

The 5-year survival was 77% for African-Americans and 84% for European-Americans. The crude estimates by race are shown in Fig. 1. African-American women had poorer survival compared with European-American women (hazard ratio = 1.6; 95% CI = 1.1–2.2). Table 2 presents the hazard ratios adjusted for pathologic stage and sociodemographic factors, separately and in combination. When stage was added to the model, the hazard ratio decreased to 1.3 (95% CI = 0.9–1.9). Adjusting only for sociodemographic factors, the hazard ratio was re-



**Fig. 1.** Crude Kaplan-Meier survival estimates, by race. For the 886 African-American and European-American women with breast cancer who were seen at the Health Alliance Plan-Henry Ford Medical Group from January 1986 through April 1996, the cumulative survival proportion at 36 months of follow-up was 0.85 (95% confidence interval [CI] = 0.80–0.89) and 0.92 (95% CI = 0.89–0.94) for European-Americans; at 72 months, the cumulative survival was 0.77 (95% CI = 0.70–0.82) for African-Americans and 0.84 (95% CI = 0.80–0.87) for European-Americans; at 108 months, the cumulative survival was 0.70 (95% CI = 0.61–0.77) for African-Americans and 0.76 (95% CI = 0.68–0.82) for European-Americans. The table below the x-axis shows the numbers of patients at risk at representative time points. Symbols used: ----- = European-American; — = African-American

duced to 1.2 (95% CI = 0.8–1.9). When we controlled for both stage and sociodemographics, the hazard ratio was reduced to 1.0 (95% CI = 0.7–1.5). The survival curves by race, adjusted for sociodemographic characteristics and stage, are shown in Fig. 2 and reflect this equivalent survival pattern. There was no evidence of violation of the proportional hazards assumption in the adjusted model.

## DISCUSSION

It is well-known that survival after breast cancer diagnosis is poorer for African-American women than for European-American women (1–3,6,13–15,17,19). It is difficult to summarize the pertinent literature because no two studies are precisely comparable, and many papers are quoted differently by the authors who cite them. Nevertheless, some valid generalizations are relevant here. As we found, the difference in distribution of stage at detection has a major influence on differential African-American/European-American survival but does not fully explain it (6,10–15).

By studying only HAP–HFMG patients, we eliminated the issue of lack of insurance coverage for screening and diagnostic services, a factor associated with both later stage at diagnosis and lower

SES (4,6,15,23). Even within this equal-coverage population, with its relative homogeneity of health care access and delivery, a large discrepancy in stage remains between African-American and European-American women (Table 1). Our study was not designed to investigate reasons for differences in stage at detection such as mammography use. However, two existing studies, both conducted in HAP–HFMG populations during approximately the same time period as this study, shed some light on this question. These studies measured, respectively, the proportion of women more than 50 years old who received mammography according to guidelines (relatively, 5.6% fewer African-American than European-American women) (24) and the proportion of women more than 50 years old with normal screening mammograms who were screened again within 2 years (relatively, 7.2% fewer African-American than European-American women) (25). These small racial differences in mammography use among women in the same health care system as our sample have two implications: 1) The differences in mammography use are probably too small to explain the racial differences in stage at detection (relatively, 19% fewer African-American women with stage 0 or I disease; Tables 1

and 2) as implied above, uniform insurance coverage and clinical practices are not sufficient to equalize completely African-American and European-American women's use of breast cancer screening services.

Use of health care influences stage at diagnosis and the effectiveness of treatment (4,11,23). The difficulty of obtaining data on populations with even approximate uniformity of care motivates our study. Its detailed results cannot be generalized to different populations or regions, but it constitutes an important addition to the body of work that greatly reduces the influence of race on survival by adjusting for stage and SES.

Wojcik et al. (26) eliminated the insurance factor by studying women cared for in the Department of Defense system, which also tries to provide equal access. The authors found that, among women with breast cancer, after adjustment for age and stage, European-American women had better survival than African-American women; however, Wojcik et al. did not control for income, a factor that varied by race in our sample of HMO members.

In our population, sociodemographic variables and stage, taken separately, had comparable confounding effects on the association between race and survival. As noted by Weiss et al. (27) and illustrated in the literature that we cite, SES is difficult to quantify and consists of a constellation of factors, although income plays a primary role. We know of one study besides our own that employs census data at the block group level (28) to improve the precision of SES estimates. Bassett and Krieger (16) do this by using six measures of SES other than income, and they adjust for age and stage. However, they did not study a sample with equivalent health care coverage. Both our study and that of Bassett and Krieger (16) come very close to eliminating race as an independent influence on survival.

The results of our study indicate that factors other than the ability to pay for services affect breast cancer survival. These factors may have some influence on stage at detection in particular. They include various beliefs about cancer risk and the usefulness of early detection, differences in the effects of various outreach and reminder strategies, differences in access mediated by transportation or the ability to get time off from work to keep appointments, obesity, comorbidities, and

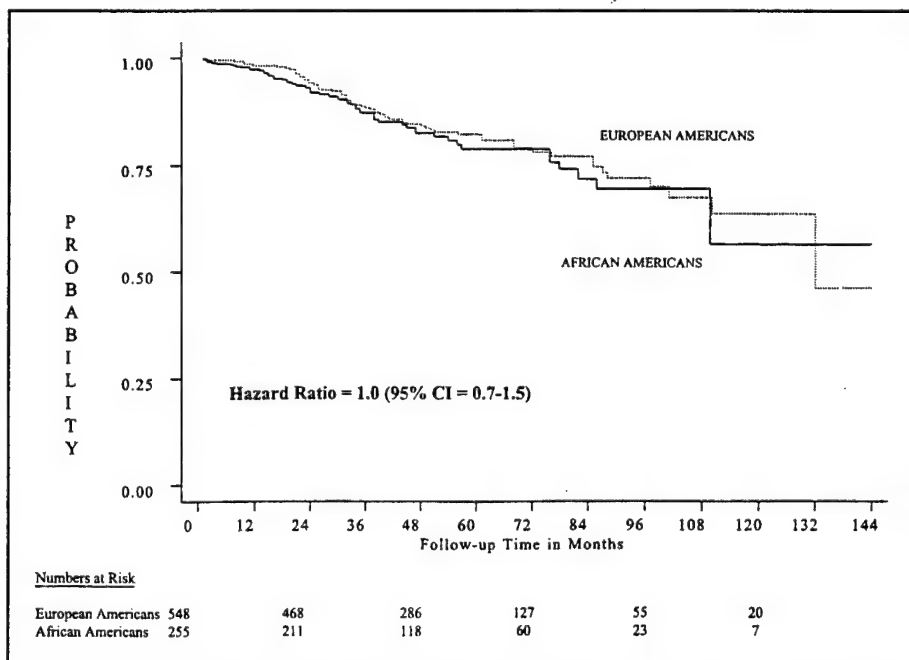


Fig. 2. Survival by race, adjusted for age, income, marital status, and stage. Adjusted Kaplan-Meier curves for 886 women with breast cancer seen at the Health Alliance Plan–Henry Ford Medical Group from January 1986 through April 1996. The table under the x-axis gives the numbers of patients at risk at representative time points. CI = confidence interval. Symbols used: ----- = European-American; — = African-American.

Table 1. Baseline demographic and tumor characteristics\*

	Value (95% CI)	
	African-American (n = 273)	European-American (n = 613)
<b>Sociodemographics†</b>		
Married	54% (48%–60%)	59% (65%–73%)
Mean age in y at diagnosis	55 (54–57)	56 (55–57)
Median household income (\$1000)	26 (24–27)	44 (42–45)
Mean HMO enrollment before diagnosis, y	6.9 (6.3–7.5)	5.4 (5.1–5.7)
<b>Tumor characteristics</b>		
Stage‡		
0	17% (13%–22%)	21% (17%–24%)
I	29% (24%–34%)	36% (32%–40%)
II	40% (34%–46%)	33% (29%–37%)
III	9% (5%–12%)	7% (5%–12%)
IV	5% (2%–8%)	3% (1%–4%)
Mean tumor size, cm	2.4 (2.1–2.6)	2.1 (2.0–2.3)

\*CI = confidence interval; HMO = health maintenance organization.

†Marital status missing for five African-American and eight European-American women. Median household income missing for 13 African-American and 56 European-American women. Both marital status and median income missing for one European-American woman.

‡Stage according to the American Joint Commission on Cancer system (21).

Table 2. Effect of demographic and tumor characteristics on survival estimates

Variables in model	Hazard ratio, African-American versus European-American		95% confidence interval
Race only	1.6		1.1–2.2
Race + stage*	1.3		0.9–1.9
Race + sociodemographic factors†	1.2		0.8–1.9
Race + stage + sociodemographic factors‡	1.0		0.7–1.5

\*Stage according to the American Joint Commission on Cancer system (21).

†Age, marital status, and median household income.

differences in breast density that modify the effectiveness of mammograms (4,11,23,29–33).

A fundamental question for us, and for the related studies we cite, is whether African-American women have intrinsically more aggressive tumors than European-American women, thus affecting their survival either directly or by way of stage at detection because of more rapid progression. Our study did not incorporate estrogen receptor status or histologic tumor grade because they were often omitted from the HFMG tumor registry and, when available, had not been evaluated consistently.

The literature can be roughly divided into studies that find intrinsic differences in tumor aggressiveness (higher nuclear and histologic grade, S-phase fraction or mitotic index, and estrogen receptor negativity) to exercise a major influence on differential African-American/European-American survival (6,9,10), and the greater number that find no positive evidence for this effect because they attribute a very limited influence to race after ad-

justment for stage and SES (15–20). In a population with uniform health care coverage, we found that the residual influence of race after adjustment is negligible (hazard ratio = 1.0; 95% CI = 0.7–1.5). This result lends support to the view that the effect of an intrinsic difference in tumor biology (if any) must be small and exercised mainly through its influence on stage at diagnosis.

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## NOTES

<sup>1</sup>*Editor's note:* SEER is a set of geographically defined, population-based, central cancer registries in the United States, operated by local nonprofit organizations under contract to the National Cancer Institute (NCI). Registry data are submitted electronically without personal identifiers to the NCI on a biannual basis and the NCI makes the data available to the public for scientific research.

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# Racial differences in the presentation and surgical management of breast cancer

Vic Velanovich, MD, Marianne Ulcickas Yood, DSc, Ulka Bawle, BS, S. David Nathanson, MD, Vernon F. Strand, MD, Gary B. Talpos, MD, Wanda Szymanski, RN, BSN, and Frank R. Lewis, Jr, MD, Detroit, Mich

**Background.** African American women are seen with more advanced breast cancers, are less likely to be treated with breast-conserving surgery, and generally have poorer prognoses than white women. There are a myriad of potential causes for these phenomena. The purpose of this study was to measure racial differences in the surgical treatment of breast cancer among women with comparable health care access and delivery.

**Methods.** The Breast Cancer Registry of the Department of Surgery at Henry Ford Hospital was accessed for all patients between January 1, 1990, and December 31, 1997 for whom data on race, tumor characteristics, stage, and treatment specifics were available. Socioeconomic information was collected with use of 1990 census block data. Proportions of women who received each treatment were compared for African Americans and whites with use of the relative risk (RR) and 95 % confidence intervals (CI). We used multiple logistic regression to obtain estimates of the relative risk, controlling for potential confounding factors.

**Results.** Of the 1699 patients in the database, 1250 had sufficient information for analysis. A total of 8.7% of African American women were diagnosed with late-stage disease (ie, stage III or IV) compared with 7.9% of whites. Nevertheless, African American women had a lower frequency of stage I disease (30.5% vs 36.2%) and a higher frequency of stage II disease (36.8% vs 31.4%). Overall and adjusted risk estimates for age, tumor stage, marital status, median income, and type of insurance revealed no substantive or statistically significant differences between African American and white patients. The adjusted RR for local excision was 1.39 (95% CI 0.78 to 2.49), for lumpectomy and axillary dissection RR 0.92 (95% CI 0.66 to 1.29), for simple mastectomy RR 0.84 (95% CI 0.41 to 1.72), and for modified radical mastectomy RR 1.00 (95% CI 0.73 to 1.36).

**Conclusions.** In this setting of equal access to health care, African American women still have higher frequencies of stage II disease, although the frequencies for late-stage disease are similar. Nevertheless, no surgical differences were found in this population, even after the effects of socioeconomic indicators and stage at diagnosis were controlled for. Survival differences between African American and white women are unlikely to be explained by differences in treatment. (Surgery 1999;125:375-9.)

From the Division of General Surgery, Henry Ford Hospital, and the Josephine Ford Cancer Center, Henry Ford Health System, Detroit, Mich

AFRICAN AMERICAN WOMEN WITH BREAST CANCER have been found to be first seen with more advanced disease and tend to have worse prognoses than white women, even when disease stage is controlled for.<sup>1</sup> Data from the National Cancer Data Base from 1995 showed that 37.5% of African Americans were first seen with stage 0 or I disease compared with 54.5% of non-Hispanic whites.<sup>2</sup> Attempts to explain

this situation have focused on differences in tumor biologic functions,<sup>1,3</sup> socioeconomic conditions,<sup>4</sup> cultural influences,<sup>5</sup> and access to health care.<sup>6</sup> Nevertheless, 25% of the difference in survival could not be explained by stage, primary tumor characteristics, treatment, socioeconomic conditions, and demographic factors.

National data show that African American women undergo breast-conserving treatment at a lower rate compared with white women.<sup>7,8</sup> In the National Cancer Data Base, 49.7% of non-Hispanic whites underwent partial mastectomy compared with 46.8% of African Americans. Some of this difference was explained by level of educations and residence in a metropolitan area.<sup>7,9</sup>

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Reprint requests: Vic Velanovich, MD, Division of General Surgery, K-8, Henry Ford Hospital, 2799 W Grand Blvd, Detroit, MI 48202-2689.

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**Table I.** Distribution of sociodemographic characteristics by race

	African American	White
Age (y)		
≤50	129 (31.0)	263 (31.5)
51-60	88 (21.2)	213 (25.5)
61-70	107 (25.7)	188 (22.5)
>70	92 (22.1)	170 (20.4)
Marital status		
Married	176 (42.3)	539 (64.6)
Unmarried	240 (57.7)	295 (35.4)
Median income		
≤\$20,000	202 (51.4)	48 (6.5)
\$20,000-\$35,000	122 (31.0)	182 (24.7)
\$35,001-\$50,000	47 (12.0)	281 (38.2)
>\$50,000	22 (5.6)	225 (30.6)
Insurance		
Health Alliance Plan	189 (45.4)	381 (45.7)
Blue Cross/Blue Shield	38 (9.1)	108 (13.0)
Medicare	151 (36.3)	254 (30.5)
Other	38 (9.1)	91 (10.9)
Total	416 (100)	834 (100)

Values are number and percent.

It has been documented that low-income patients have higher frequencies of late-stage breast cancer compared with high-income groups.<sup>2,6</sup> Low-income groups may be underinsured, limiting their ability to obtain adequate health care. This problem with access to health care is reflected in lower rates of screening mammograms, for example.<sup>6</sup> This issue accounts for some of the differences seen between these groups.<sup>10</sup>

The hypothesis of this study is that in a managed care system with equivalent access to health care for whites and African Americans there should be no difference in stage of presentation or surgical treatment if these differences are entirely the result of factors reflecting access to health care.

## MATERIAL AND METHODS

**Setting.** The Henry Ford Health System (HFHS) is an integrated managed care organization serving southeastern Michigan. The tertiary hospital, Henry Ford Hospital, serves not only the system's health maintenance organization (HMO) patients but also out-of-system referrals (such as fee-for-service insurers). In 1990 the Department of Surgery developed a breast cancer registry as a comprehensive database that includes information on treatments and outcomes for all breast cancer patients evaluated within the HFHS. The registry records data on age, race, tumor size, lymph node status, pathologic stage, surgical treatment, hormonal treatment, cytotoxic chemotherapy, and radiation treatment in addition to other tumor-specific data.

**Identification of the study population.** From the Breast Cancer Registry we identified all African American and white women seen at HFHS with newly diagnosed breast cancer between January 1, 1990, through December 31, 1997. From this group we excluded those for whom the registry had missing stage, treatment, or nodal status data.

**Classification of the stages.** Stages were classified in the following manner: stage 0, in situ breast ductal carcinoma (Tis); stage I, invasive ductal, lobular, tubular, or medullary carcinomas <2 cm (T1) without axillary lymph node metastasis (N0); stage II, invasive ductal, lobular, tubular, or medullary carcinomas >2 cm (T2 and T3) without lymph node metastasis (N0) or <5 cm in size without signs of direct extension to the chest wall or skin (ie, excluding T4 lesions) but with lymph node metastasis; stage III, any tumor with locally invasive lesions to chest wall or skin (T4) or tumor of any size with fixed axillary lymph nodes (N2); and stage IV, metastasis to distant organs (all M1).

**Treatment and confounding data.** We classified surgical treatment into 4 categories: (1) local excision, removal of mass with or without margins negative for tumor with or without adjuvant radiation therapy; (2) lumpectomy and axillary lymph node dissection, removal of mass with negative margins with axillary lymph node dissection; (3) simple mastectomy, removal of entire breast without axillary lymph node dissection; and (4) modified radical mastectomy, removal of the entire breast with axillary lymph node dissection.

**Table II.** Tumor characteristics of study population

	African American	White
Tumor stage		
0	100 (24.0)	204 (24.5)
I	127 (30.5)	302 (36.2)
II	153 (36.8)	262 (31.4)
III	31 (7.5)	61 (7.3)
IV	5 (1.2)	5 (0.6)
	$P = .18$	
Tumor size (cm)*		
≤2	35 (19.1)	92 (28.4)
2-5	110 (60.1)	171 (52.8)
>5	27 (14.8)	29 (9.0)
Extended	11 (6.0)	32 (9.9)
	$P = .014$	
Nodal status*		
0	65 (34.8)	87 (26.6)
1	111 (59.4)	229 (70.0)
2	11 (5.9)	11 (3.4)
	$P = .04$	

Values are number and percent.

\*Includes only patients stages II to IV.

From the HFHS patient registration system we obtained marital status, insurance, and address. We mapped each woman's address to census block groups and estimated household income on the basis of block-group-specific 1990 census data.

**Data analysis.** Nominal data was analyzed with the chi-square test and randomization test as appropriate with the True Epistat<sup>11</sup> statistical computer program.

For each treatment category we separately calculated the proportion of African American and white women who received each treatment. We compared these proportions with use of relative risks (RR) and corresponding 95% confidence intervals (CI). We calculated the RR by dividing the proportion of African American women who received each treatment by the proportion of white women who received the treatment.

To control potential confounding, we used SAS statistical software (SAS Institute, Cary, NC) to fit a multiple logistic regression model including tumor stage (0, I, II, III, and IV); age (≤50, 51 to 60, 61 to 70, and >70 years old); marital status (married or unmarried); median income (≤\$20,000, \$20,001 to \$35,000, \$35,001 to \$50,000, and >\$50,000); and insurance (HMO, Blue Cross, Medicare, and other) as indicator terms. From the logistic model we obtained the odds ratio, which approximates the RR when the proportions are small, as they are in this study.

## RESULTS

We identified 1699 women with newly diagnosed breast cancer from January 1, 1990, through

December 31, 1997. We excluded 78 women who were not African American or white. We also excluded 180 women with missing stage information, 53 women without definitive treatment data, and 138 women with missing nodal status data, leaving a final study population of 1250 women.

The distribution of sociodemographic characteristics by race is shown in Table I. The age distribution was similar for African Americans and whites. African American women were more likely to be unmarried and had lower median household incomes compared with white women. In both groups almost half the women were members of the HFHS HMO, the Health Alliance Plan.

Table II shows the tumor characteristics of the study population. Almost 46% of African Americans were first seen with regional or distant (stage II, III, and IV) disease compared with 39% of whites ( $P = .04$ ). Among those with stage II tumors, for which staging depends on nodal status and size, African Americans were more likely to have tumors >2 cm compared to whites (RR = 1.48, 95% CI 1.08 to 2.03), whereas African Americans were less likely to have nodal involvement than whites (RR = 0.85, 95% CI 0.71 to 1.0). Specifically, African Americans had a higher frequency of T2 and T3 tumors compared with whites ( $P = .014$ ). But, surprisingly, they had also a higher frequency of node-negative disease ( $P = .04$ ).

The distribution of treatments by race is shown in Table III. We found that overall and after adjustment for age, tumor stage, marital status, estimated



**Table III.** Distribution of treatments by race and relative risk of receiving specific treatments comparing African Americans with whites

<i>Surgical treatment</i>	<i>African American</i>		<i>White</i>
Conservative breast surgery			
Local excision			
Yes	80	(19.2)	156 (18.7)
No	336	(80.8)	678 (81.3)
Crude RR (95% CI)	1.03	(0.81-1.31)	1.0
Adjusted RR (95% CI)*	1.39	(0.78-2.49)	1.0
Lumpectomy and axillary dissection			
Yes	147	(35.3)	321 (38.5)
No	269	(64.7)	513 (61.5)
Crude RR (95% CI)	0.92	(0.79-1.07)	1.0
Adjusted RR (95% CI)*	0.92	(0.66-1.29)	1.0
Nonconservative breast surgery			
Simple mastectomy			
Yes	15	(3.6)	31 (3.7)
No	401	(96.4)	803 (96.3)
Crude RR (95% CI)	0.97	(0.53-1.78)	1.0
Adjusted RR (95% CI)*	0.84	(0.41-1.72)	1.0
Modified radical mastectomy			
Yes	173	(41.6)	325 (40.0)
No	243	(58.4)	509 (60.0)
Crude RR (95% CI)	1.07	(0.93-1.23)	1.0
Adjusted RR (95% CI)*	1.00	(0.73-1.36)	1.0
Total	416	(100)	834 (100)

\*Adjusted for age, tumor stage, marital status, median income, and type of insurance.

household income, and insurance, African Americans and whites received similar treatments. When we dichotomized surgery as nonconserving (simple mastectomy and modified radical mastectomy) or conserving (local excision and lumpectomy with axillary dissection), we found no racial differences in treatment (adjusted RR = 0.97, 95% CI 0.72 to 1.31).

## DISCUSSION

Simon and Severson<sup>12</sup> with use of the Surveillance, Epidemiology, and End-Results Program data for the metropolitan Detroit area (where most patients treated within the HFHS reside) found that African American women were more likely to be first seen with regional or distant disease compared with white women. The staging system used by Simon and Severson<sup>12</sup> is not strictly analogous to ours because some of our stage II and III patients may not have lymph node metastasis but rather large primary tumors. Nevertheless, if we define stage II, III, and IV patients as those with regional and distant disease, then the rate for African Americans in the Detroit metropolitan area derived from the data of Simon and Severson versus that of the HFHS for distant disease (44.5% vs 45.5%, respectively) and whites (36.5% vs 39.3%, respectively) are similar. This

implies that stage at presentation in a managed care organization is not different than for the regional population as a whole.

Once seen for care, treatment selection is no different between African Americans and whites in our setting. Data from Muss et al<sup>7</sup> reported in 1992 that 14% of African American women underwent breast-conserving treatment compared with 27% of white women. In our institution from 1990 to 1997 breast conservation was achieved in >55% for both races. These data also compare favorably with the 35% breast conservation rate published by Lazovich et al<sup>9</sup> in 1991, who claimed that breast conservation surgery is underused. Some of these differences between our data and those of Muss et al<sup>7</sup> and Lazovich et al<sup>9</sup> could be attributed to the general increase in breast conservation after 1992. In addition, others<sup>13,14</sup> have shown that failure rates, cosmetic results, and treatment compliance were the same in whites and African Americans. In our managed care system all new breast cancer patients are managed by a breast surgeon, medical oncologist, and a radiation oncologist with a consensual team approach that does not distinguish between African Americans and whites.<sup>15</sup>

More vexing is the problem of higher-stage presentation for African Americans. Differences in

tumor biology appear to account for a small proportion of this gap.<sup>3</sup> Differences in mammographic screening also appear to play a limited role.<sup>16</sup> In a population-based study Jones et al<sup>16</sup> found that whites were twice as likely as African Americans to undergo screening mammography. However, after adjustment for mammography, the risk of later-stage disease in African Americans was decreased only minimally. Screening compliance in the HFHS is 73%. Patients of lower socioeconomic status are first seen with higher-stage disease and have lower stage-dependent survival.<sup>4</sup> On the other hand, Franzini et al<sup>17</sup> found in their population in Texas that after adjustment for socioeconomic status race was not a significant predictor of breast cancer mortality. Therefore, at best, survival differences can only partially be explained by poorer access to care, even when all other variables are evaluated.

Cultural differences might be implicated. Royal-Schaler et al<sup>5</sup> have shown that first-degree relatives of African American women with breast cancer significantly underestimate their risk for development of breast cancer and had less knowledge of the symptoms of breast disease. These authors suggested a program of systematic education to enhance African American women's understanding of breast cancer and its symptoms. Presumably, this would promote early recognition of breast cancer in this group.

In conclusion, we have demonstrated a higher rate of stage II breast cancers in African American women compared with white women but similar rates of advanced (stage III and IV) disease in a managed care environment that provides equal access to health care. However, the choice of treatment between groups is similar, implying that equal counseling to the treatment options will lead to an equal distribution of surgical treatments.

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